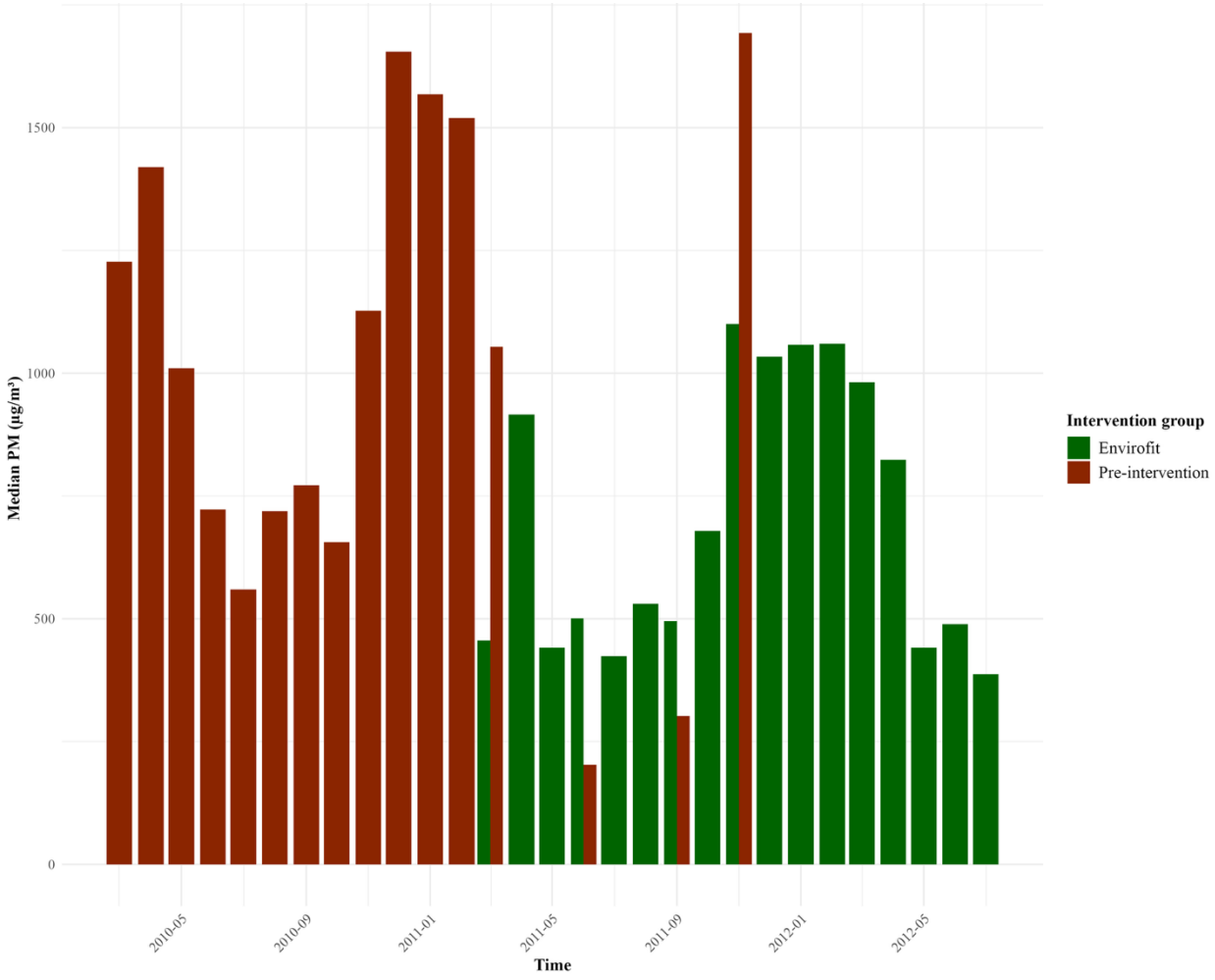
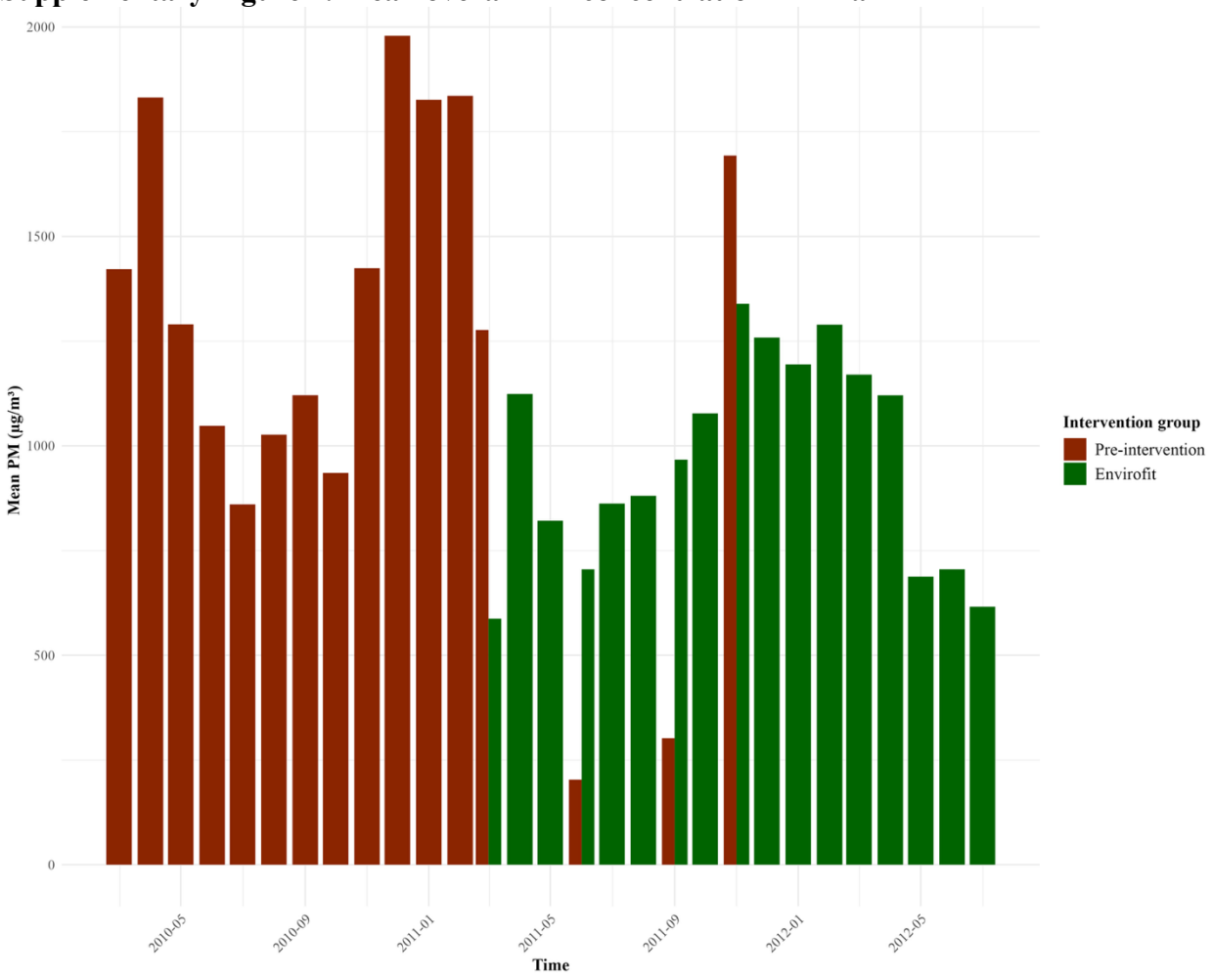
Appendix A. Chapter 2 Supplementary Figures and Tables

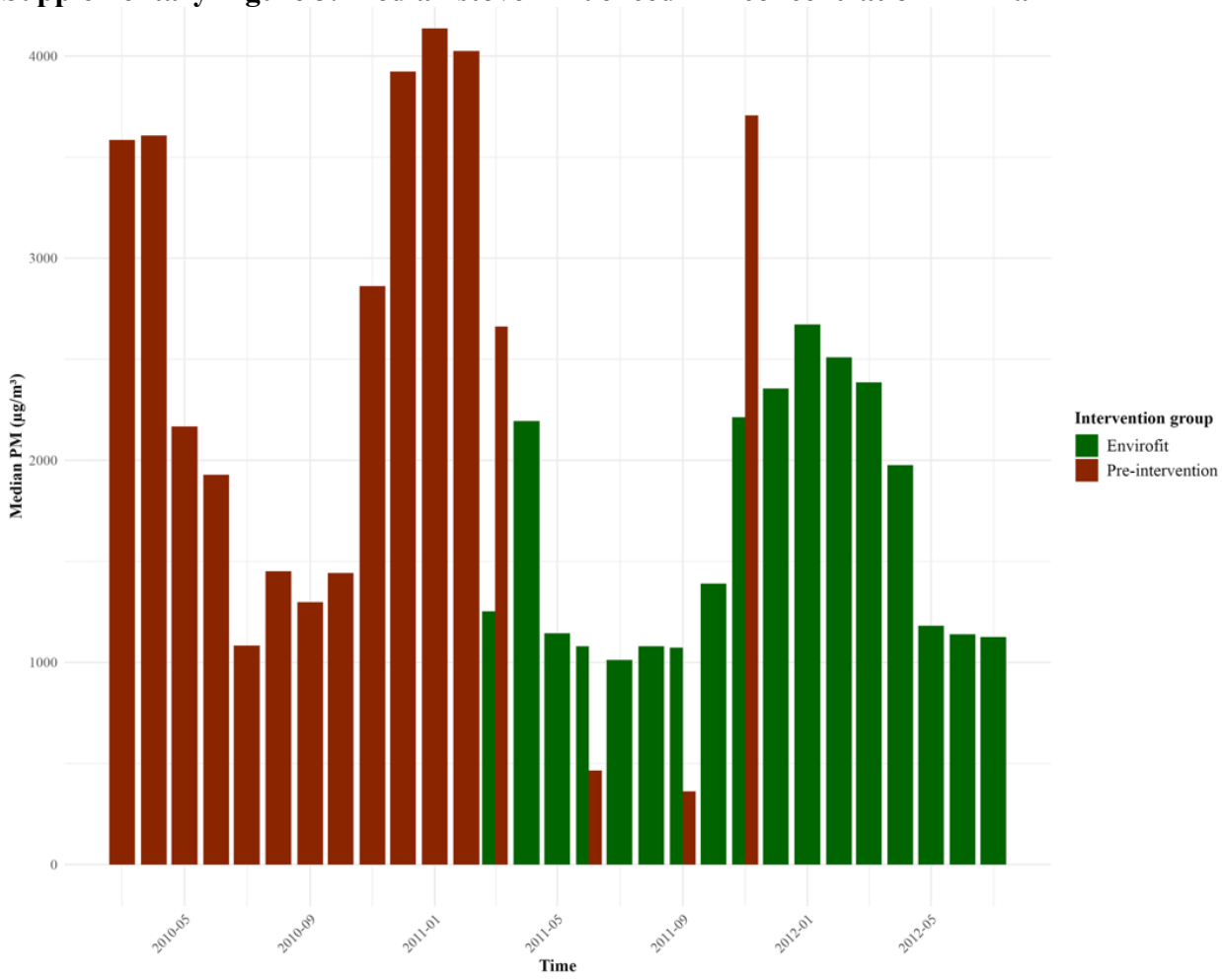
Supplementary Figure 1. Median PM concentration overtime in Trial 1



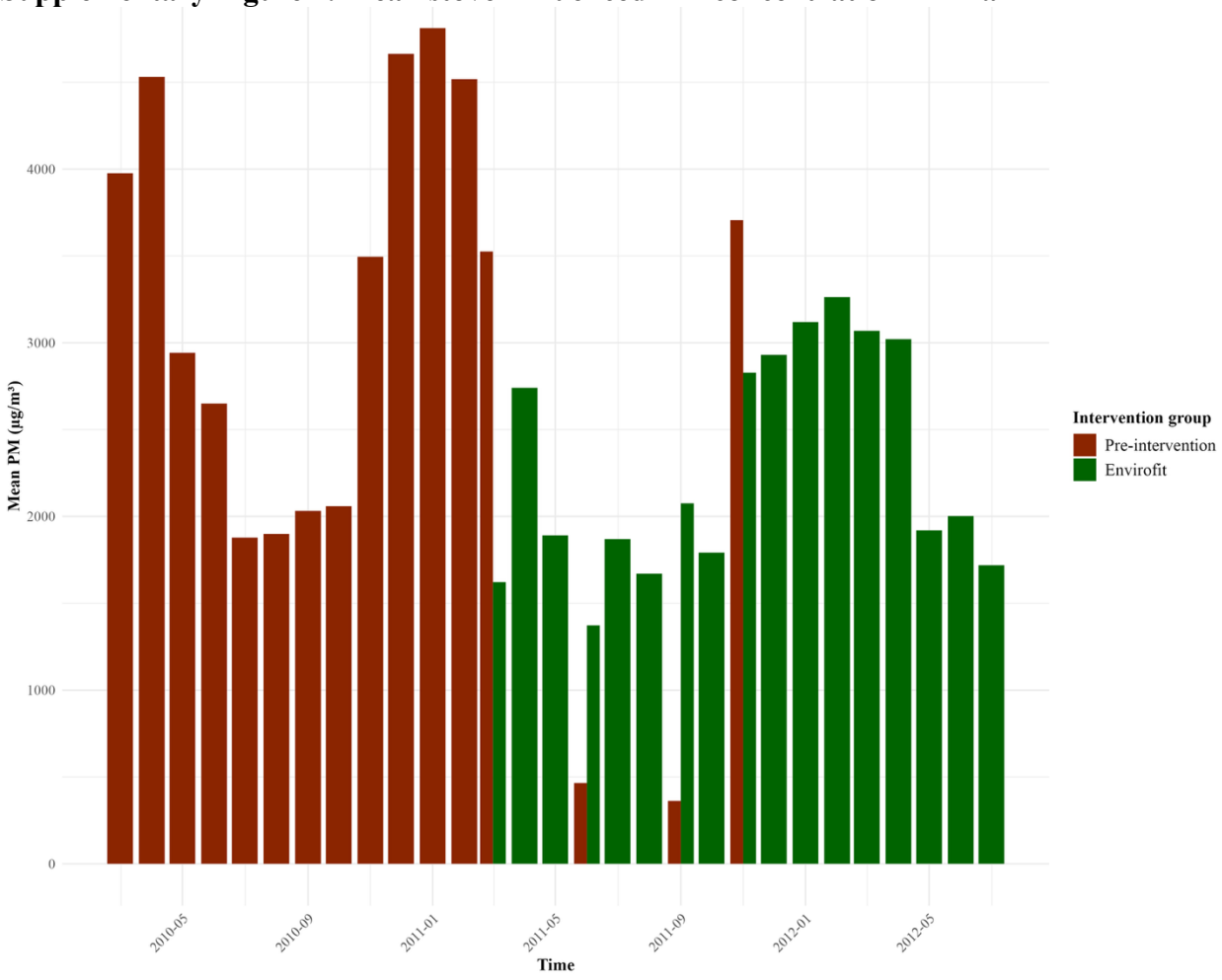
Supplementary Figure 2. Mean overall PM concentration in Trial 1



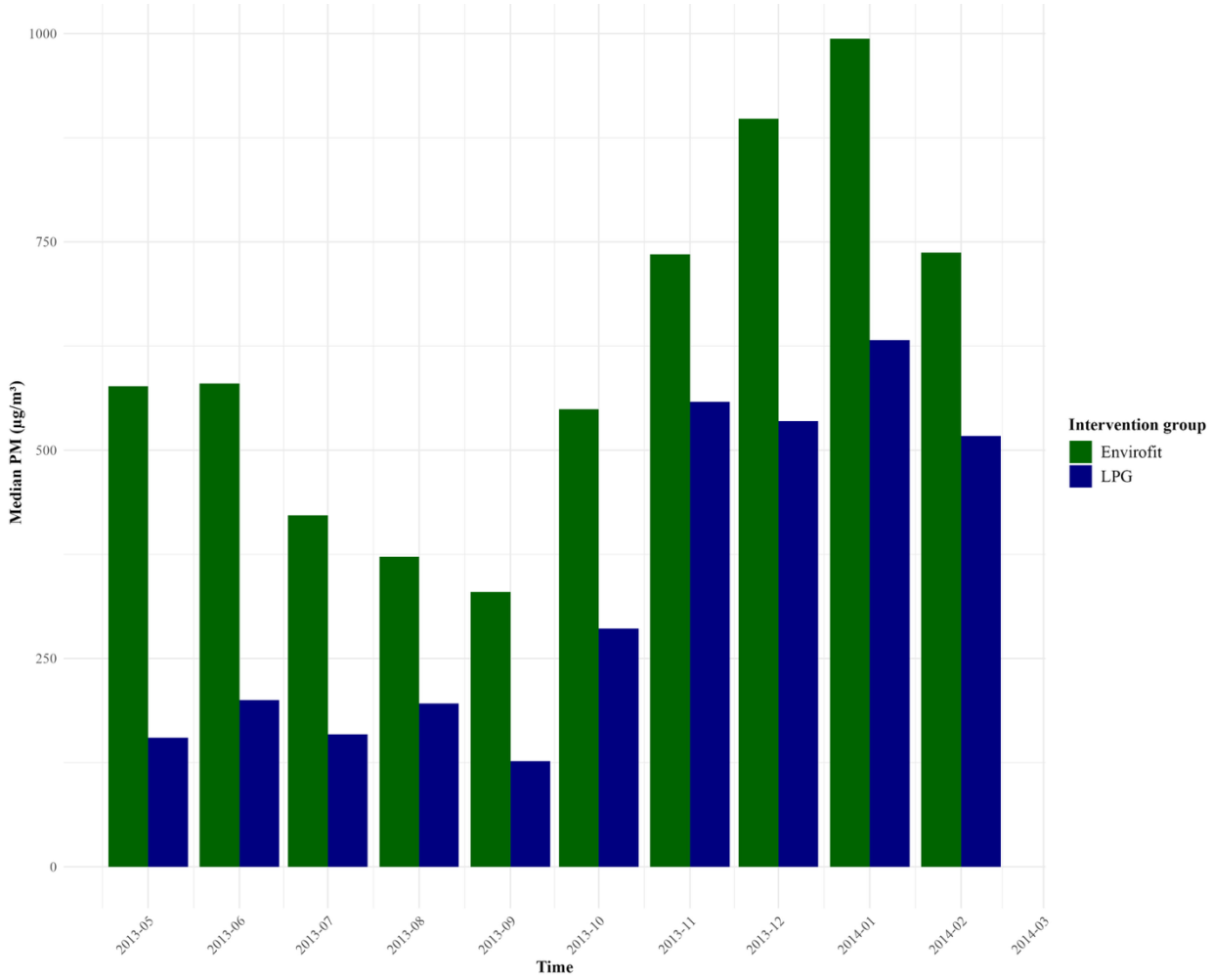
Supplementary Figure 3. Median stove-influenced PM concentration in Trial 1



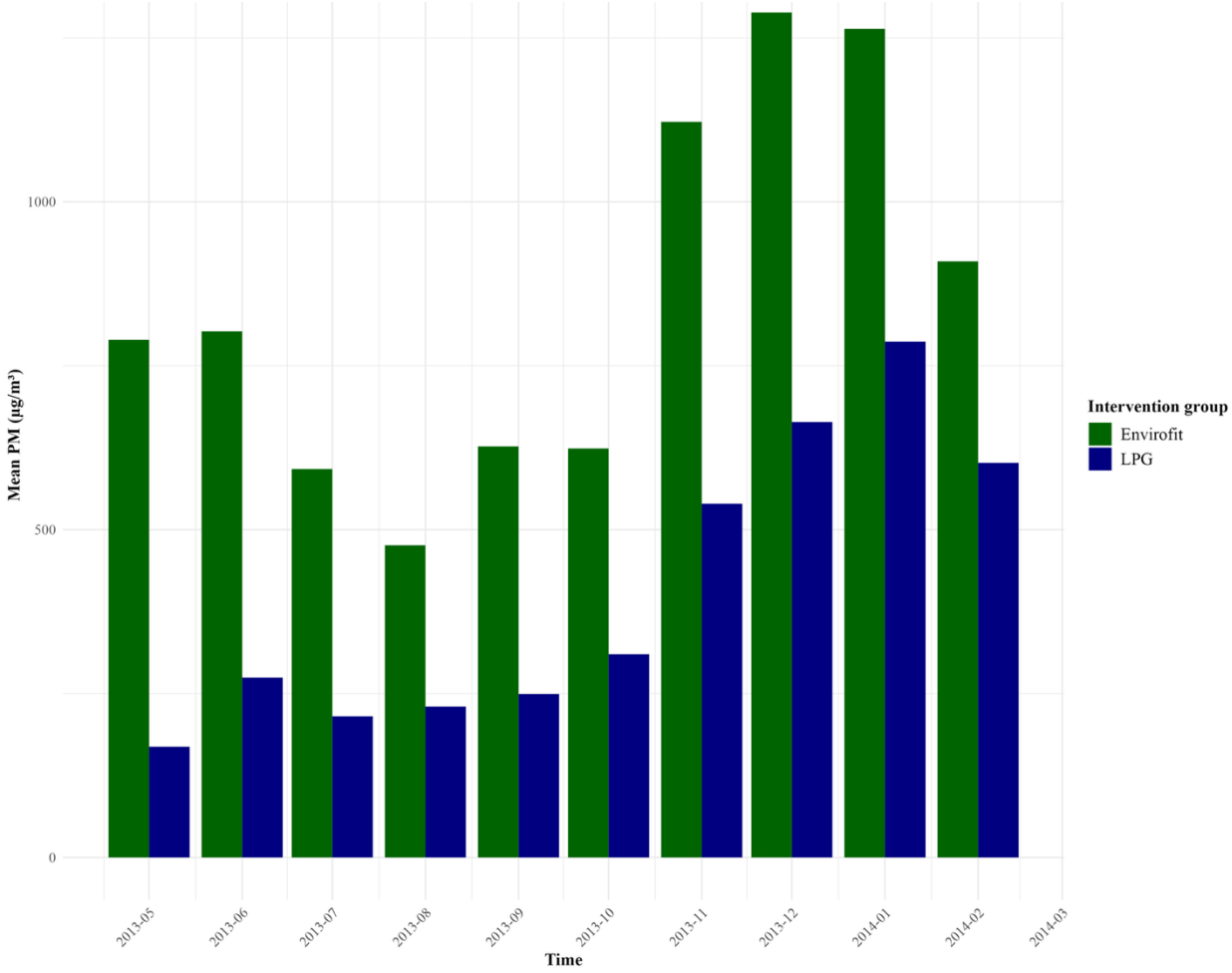
Supplementary Figure 4. Mean stove-influenced PM concentration in Trial 1



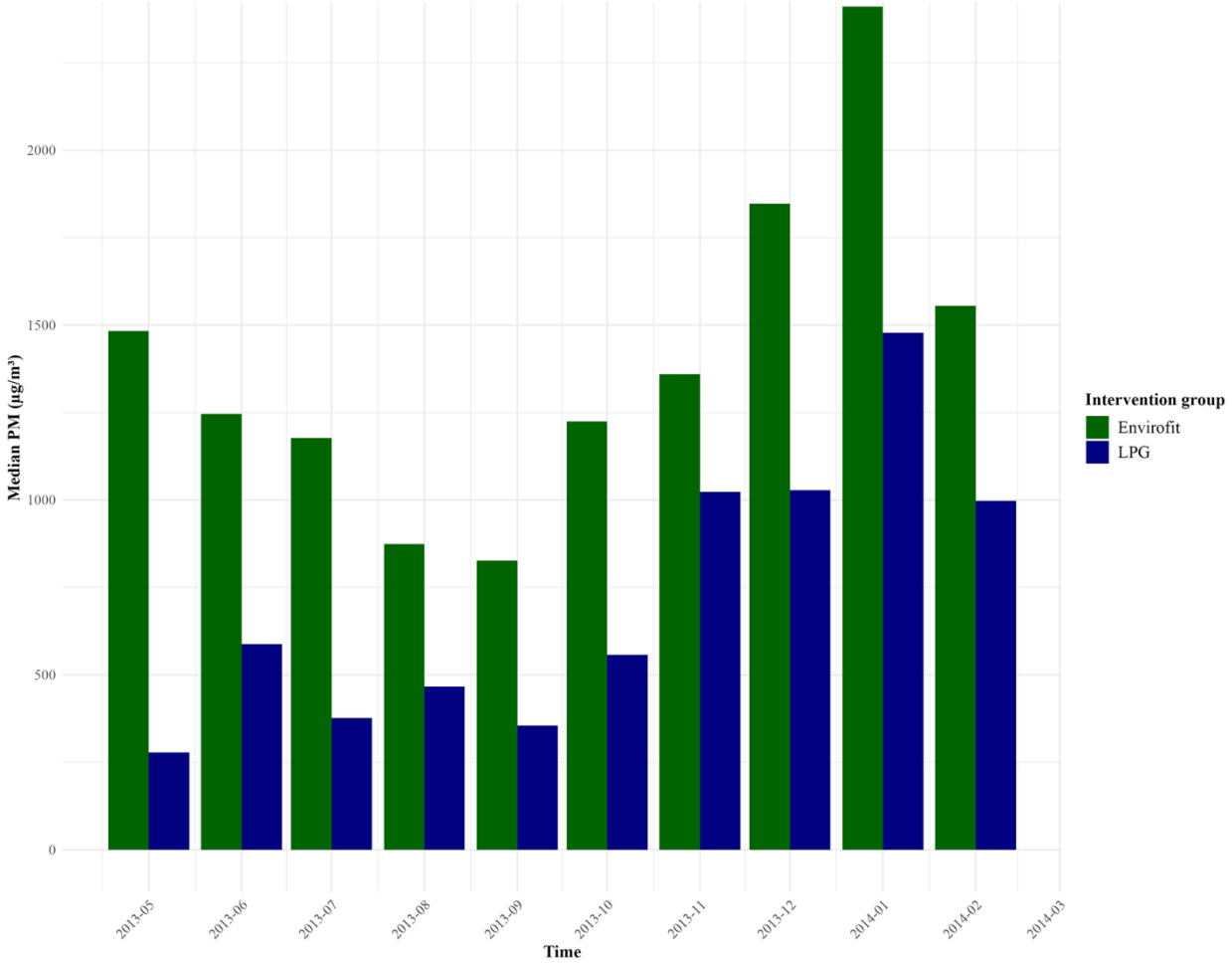
Supplementary Figure 5. Median overall PM concentration in Trial 2



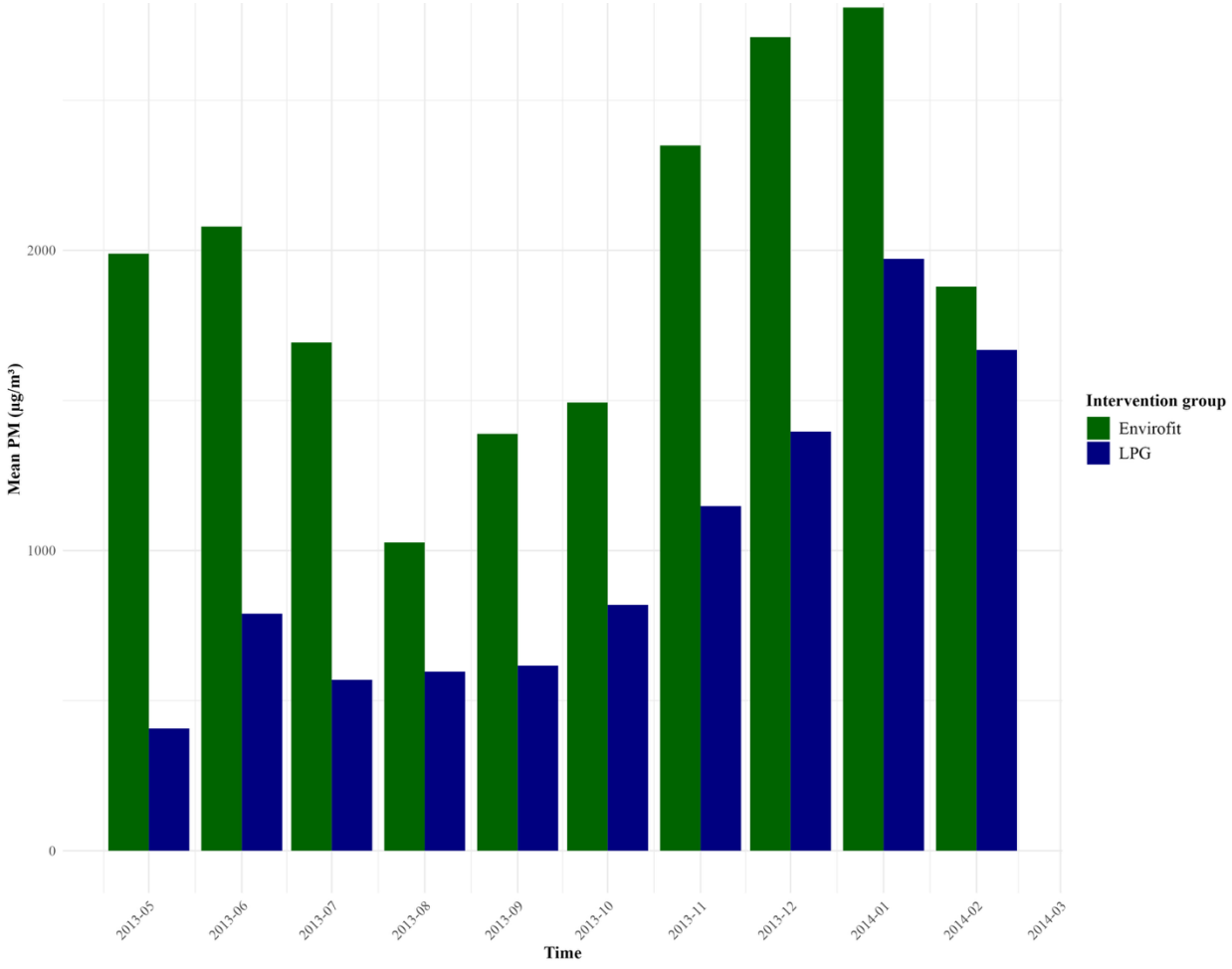
Supplementary Figure 6. Mean overall PM concentration in Trial 2



Supplementary Figure 7. Median stove-influenced l PM concentration in Trial 2



Supplementary Figure 8. Mean stove-influenced PM concentration in Trial 2



Supplementary Table 1. **Respiratory morbidity incidence rates in person-year by intervention status in Trial 1 and Trial 2**[1-3]

	Trial 1 N = 4,748					
	Pre-intervention			**Post-intervention**		
	ALRI	**ARI**	**ILI**	**ALRI**	**ARI**	**ILI**
N at risk	3,650	3,650	3,650	3,525	3,525	3,525
Total PY	2702.68	2702.68	2702.68	2,932.21	2,932.21	2,932.21
N of cases	933	882	698	263	280	224
Incidence (95% CI)	0.35 (0.32, 0.37)	0.33 (0.31, 0.35)	0.26 (0.24, 0.28)	0.09 (0.08, 0.1)	0.1 (0.09, 0.11)	0.08 (0.07, 0.09)
	Trial 2 N = 2,868					
	Envirofit			**LPG**		
	ALRI	**ARI**	**ILI**	**ALRI**	**ARI**	**ILI**
N at risk	1,404	1,404	1,404	1,464	1,464	1,464
Total PY	1171.59	1171.59	1171.59	1220.73	1220.73	1220.73
N of cases	34	32	26	26	28	26
Incidence (95% CI)	0.03 (0.02, 0.04)	0.03 (0.02, 0.04)	0.02 (0.01, 0.03)	0.02 (0.01, 0.03)	0.02 (0.02, 0.03)	0.02 (0.01, 0.03)

1. Number of participants
2. Incidence rate in person-year with 95% confidence intervals
3. ALRI: Acute Lower Respiratory Tract Infection, ARI: Acute Respiratory Tract Infection, ILI: Influenza-like Illness, PY: Person-year, N: Number

Supplementary Table 2. Total and stove-influenced median PM concentrations by intervention status in Trial 1 and Trial 2[1-2]

PM type (ug/m^3)	Trial 1			
	Pre-intervention N = 2,328		Post-intervention N = 2,219	
	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)
Overall				
Total PM	1,123 (1,217)	1416.65 (1175.68)	676 (829.25)	979.64 (1138.88)
Stove-influenced PM	2719 (3149)	3384.44 (2836.46)	1,601 (2100)	2320.44 (2619.75)
Indoor stove				
Total PM	1122 (1219)	1410.16 (1161.59)	692 (847)	981.26 (1152.47)
Stove-influenced PM	2698 (3130)	3371.88 (2830.21)	1596 (2072)	2322.24 (2651.22)
Outdoor stove				
Total PM	1136 (1223)	1512.54 (1363.38)	697 (745)	958.31 (893.44)
Stove-influenced PM	2784 (3332)	3569 (2920.55)	1713 (2359)	2301.17 (2044.58)
PM type (ug/m^3)	**Trial 2**			
	Envirofit N = 638		LPG N = 644	
	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)
Overall				
Total PM	649 (867)	905.33 (950.33)	286 (470)	460.48 (529.27)
Stove-influenced PM	1,347 (1,998)	2045.78 (2202.37)	671 (1,008)	1117.26 (1273.22)
Indoor stove				
Total PM	649 (816)	865.43 (826.9)	284 (459)	460.86 (537.26)
Stove-influenced PM	1,307 (1,918)	1953.61 (2027.85)	670 (1,017)	1124.84 (1017)
Outdoor stove				
Total PM	662 (937)	1070.95 (1334.03)	314 (542)	454.86 (391.59)
Stove-influenced PM	1,360 (2,103)	2427.95 (2103)	694 (921)	1002.09 (921)

1. N = Number of households
2. All comparisons were statistically significant ($p < 0.01$), with p-values calculated using the Wilcoxon rank-sum test

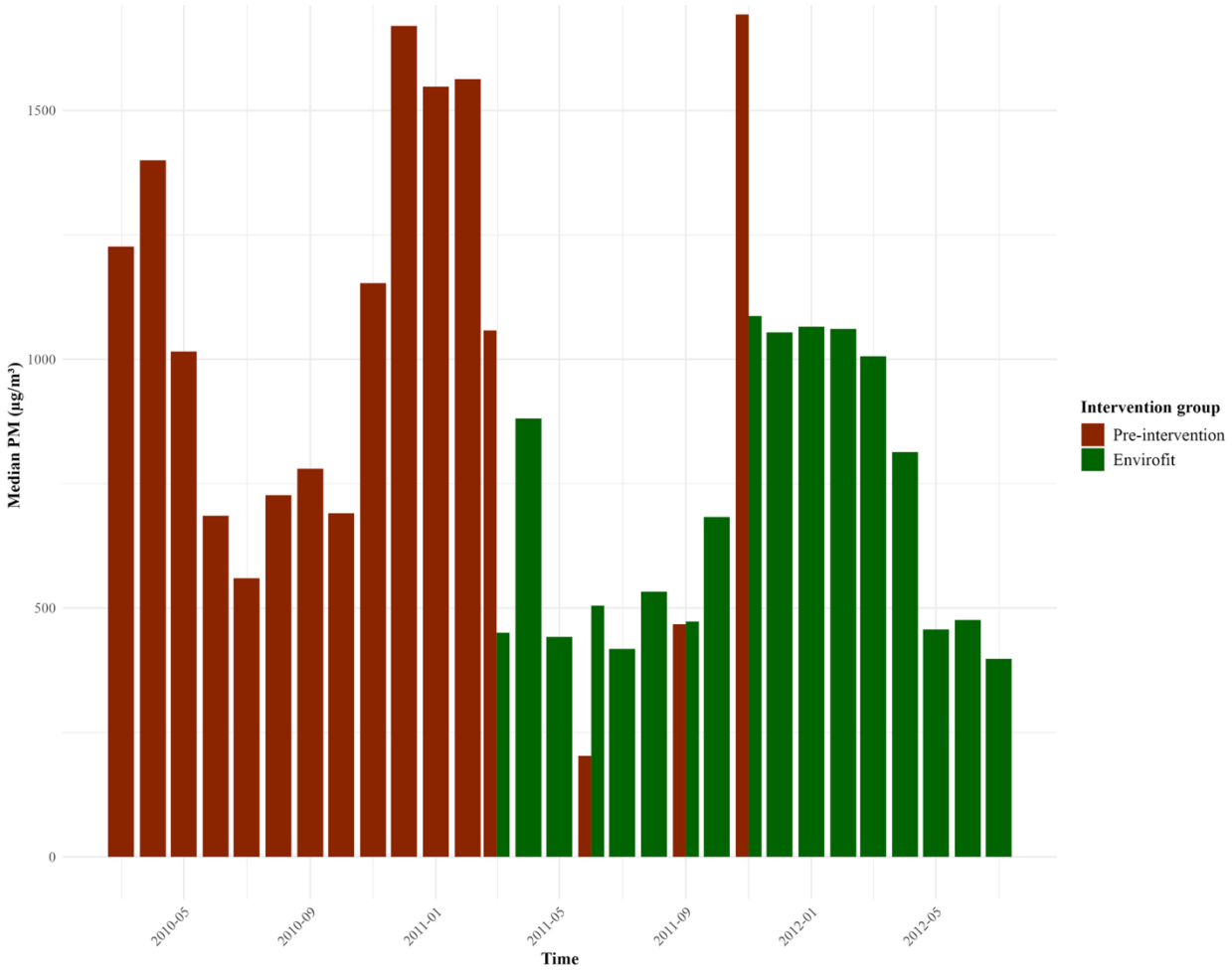
Supplementary Table 3. Stove compliance rate in Trial 1 and Trial 2[1]

Compliance rate (%) Median (IQR)	Trial 1	Trial 2		
	Envirofit N = 2,687	Envirofit N = 902	LPG N = 944	p-value
Use of interventional stove	43.06 (37.38)	61.4 (49.78)	96.15 (7.92)	< 0.001
Use of non-interventional stove	94.55 (15.22)	94.55 (19.67)	11.32 (14.01)	< 0.001

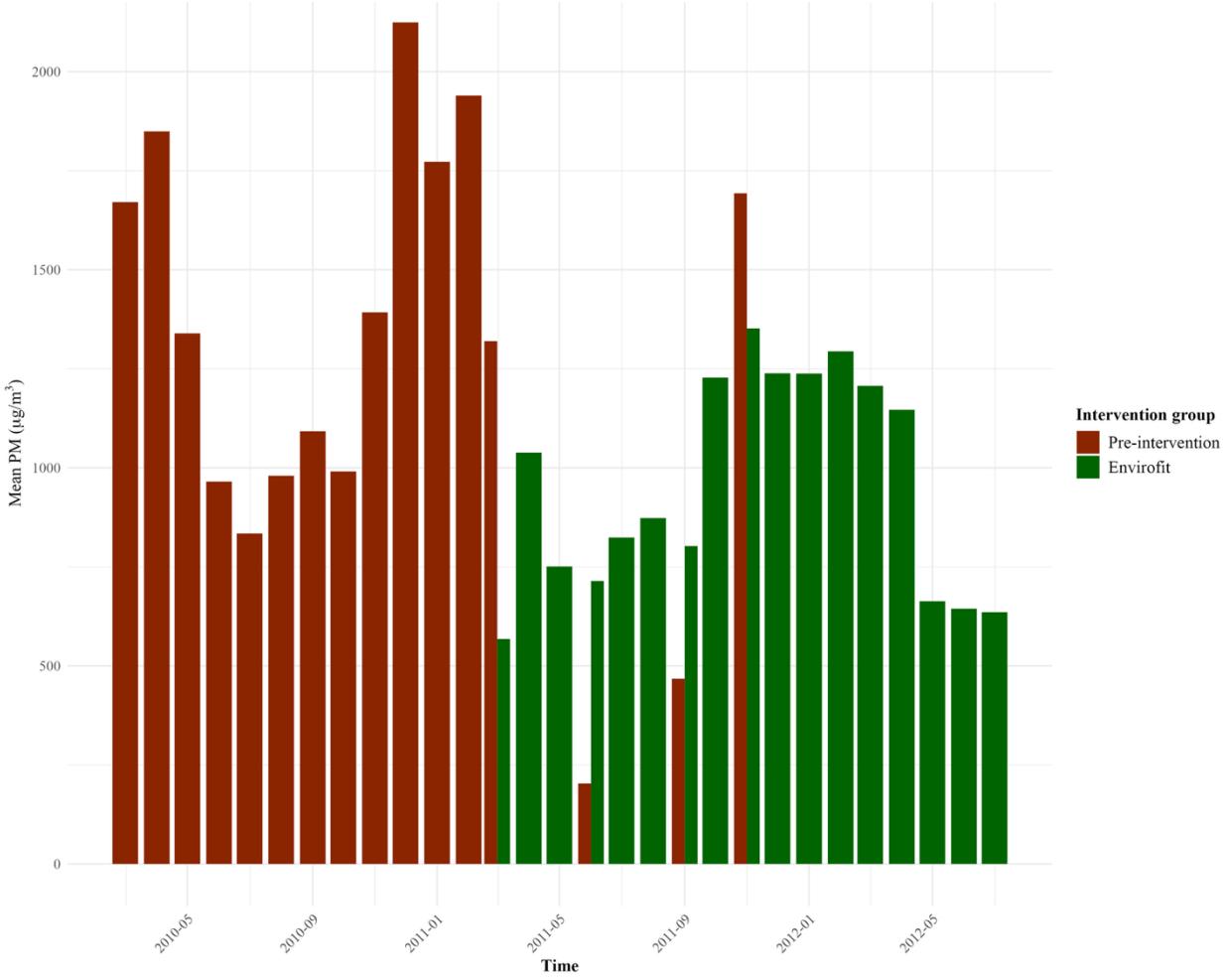
1. N = Number of households, p-value calculated using Wilcoxon-rank sum test comparing compliance rates between Envirofit and LPG groups

Appendix B. Chapter 2 Supplementary Figures and Tables

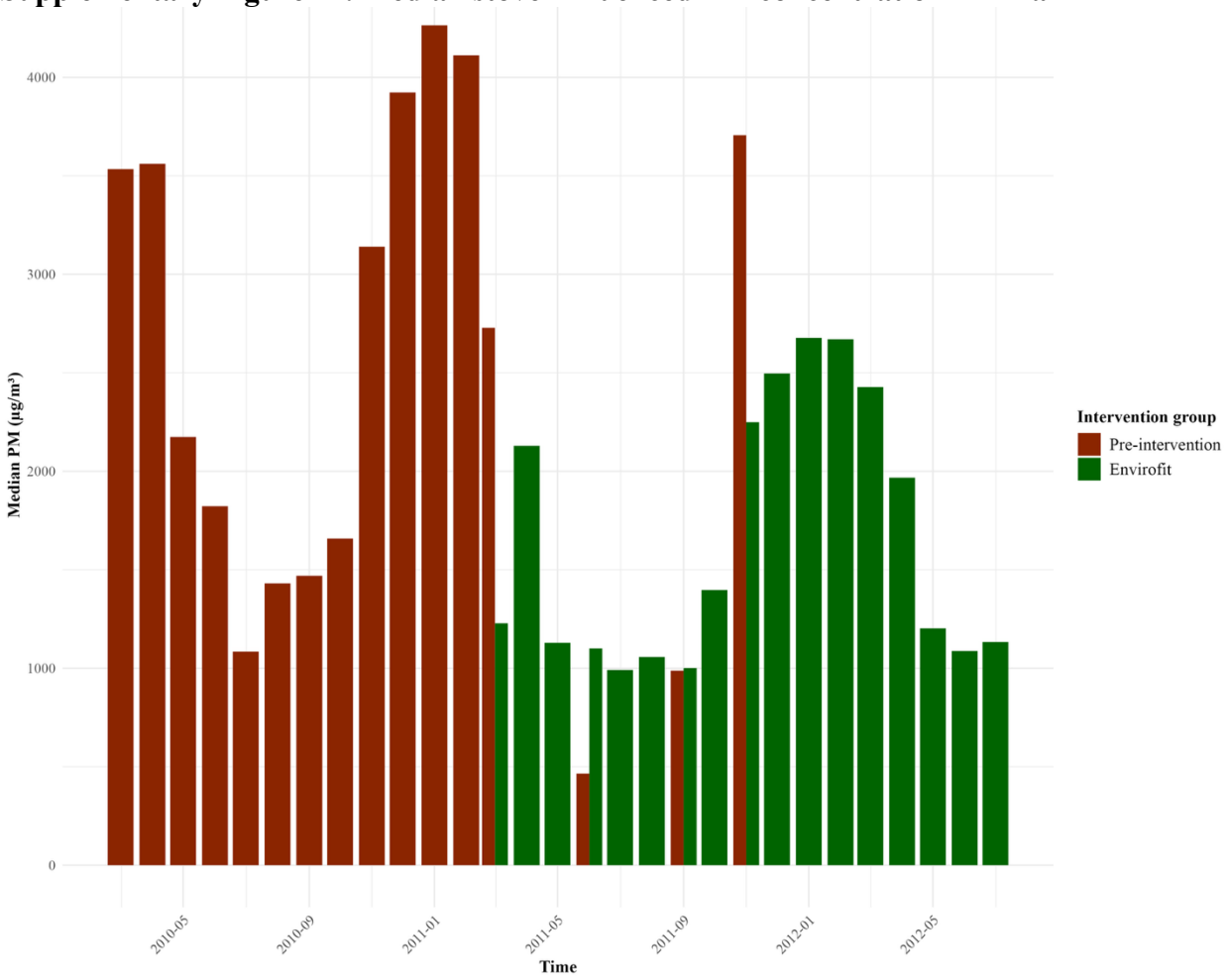
Supplementary Figure 9. Median overall PM concentration in Trial 1



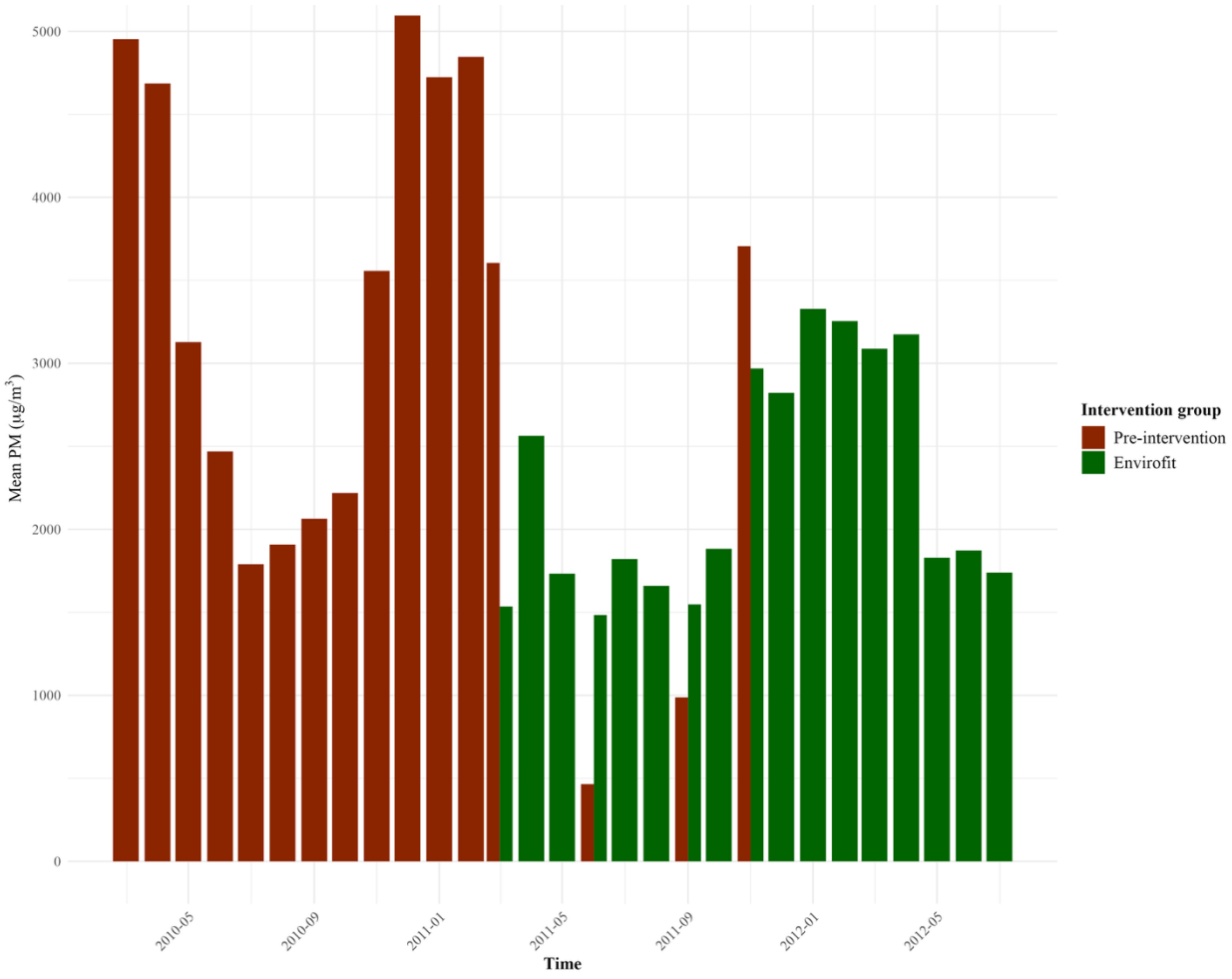
Supplementary Figure 10. Mean overall PM concentration in Trial 1



Supplementary Figure 11. Median stove-influenced PM concentration in Trial 1



Supplementary Figure 12. Mean stove-influenced PM concentration in Trial 1



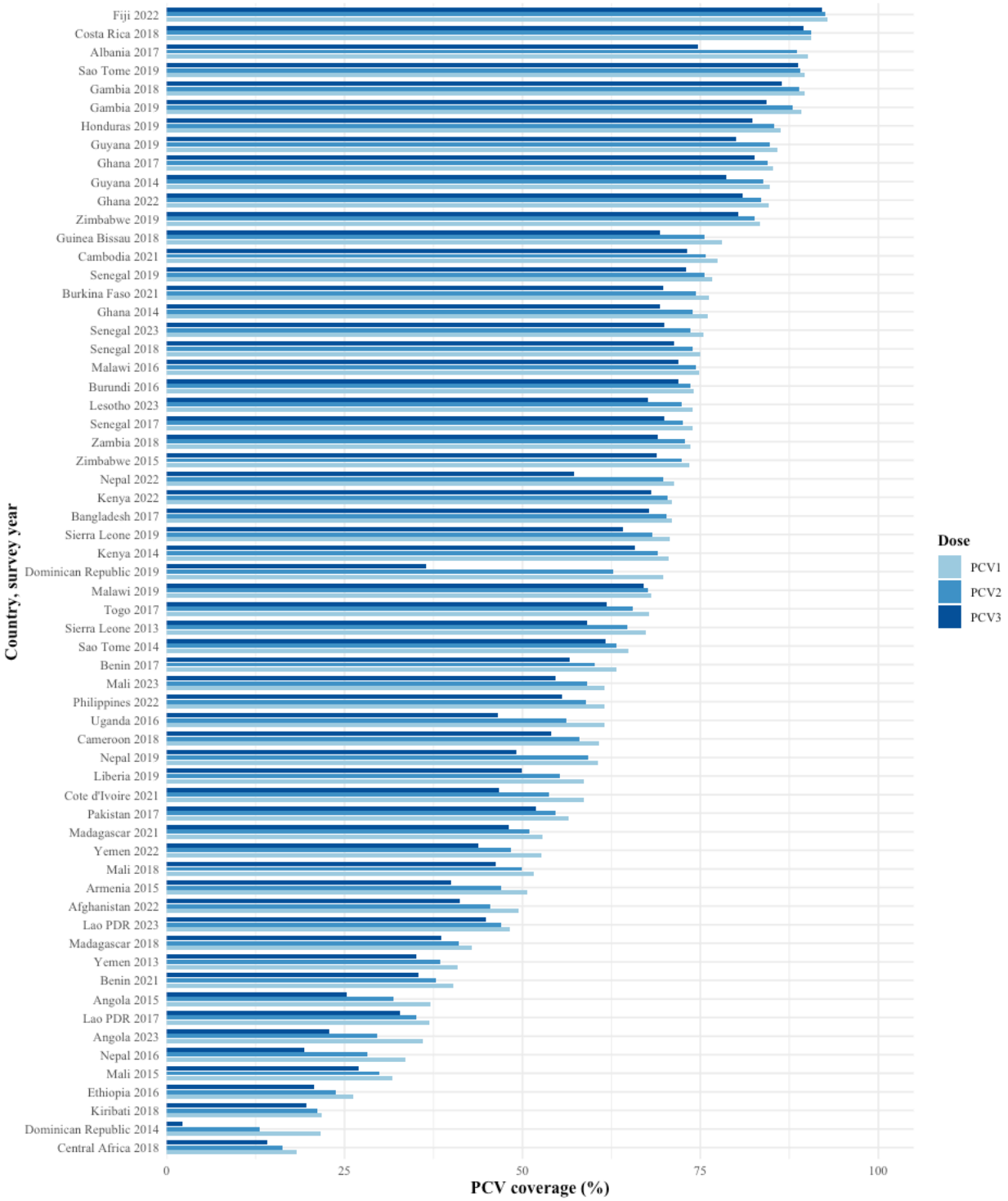
Supplementary Table 4. FEV_1/FEV_6 Pre- and Post-intervention periods[1]

	Pre-intervention		Post-intervention		
	N (%)	**Mean (SD)**	**N (%)**	**Mean (SD)**	**p-value[2]**
Overall	381 (7.24%)	0.859 (0.086)	312 (7.19%)	0.861 (0.084)	0.132
Smoker in household					
Yes	182 (10.27%)	0.846 (0.088)	166 (5.79%)	0.849 (0.089)	0.174
No	199 (5.69%)	0.865 (0.084)	146 (9.93%)	0.867 (0.08)	0.428
SES					
Poor	130 (8.13%)	0.854 (0.087)	104 (7.81%)	0.856 (0.086)	0.467
Middle	134 (7.96%)	0.858 (0.087)	107 (7.84%)	0.861 (0.083)	0.432
Higher	117 (5.91%)	0.863 (0.083)	101 (6.16%)	0.865 (0.082)	0.259
Obese[3]					
Yes	164 (9.83%)	0.856 (0.098)	133 (9.24%)	0.858 (0.093)	0.859
No	213 (6.08%)	0.859 (0.079)	179 (6.2%)	0.862 (0.079)	0.051
Season[4]					
Summer	103 (7.48%)	0.858 (0.086)	103 (8.69%)	0.85 (0.087)	0.003
Monsoon	91 (6.1%)	0.862 (0.08)	87 (7.47%)	0.863 (0.084)	0.235
Autumn	47 (8.27%)	0.852 (0.088)	28 (6.09%)	0.857 (0.076)	0.792
Winter	140 (7.67%)	0.857 (0.089)	94 (6.16%)	0.869 (0.082)	< 0.001
Cookstove location					
Indoor	351 (7.13%)	0.859 (0.085)	294 (7.22%)	0.861 (0.084)	0.239
Outdoor	30 (9.04%)	0.854 (0.095)	17 (6.49%)	0.868 (0.084)	0.1
Chimney installed					
Yes	374 (7.2%)	0.859 (0.086)	304 (7.1%)	0.861 (0.083)	0.994
No	7 (10.61%)	0.85 (0.088)	7 (12.73%)	0.845 (0.099)	0.126

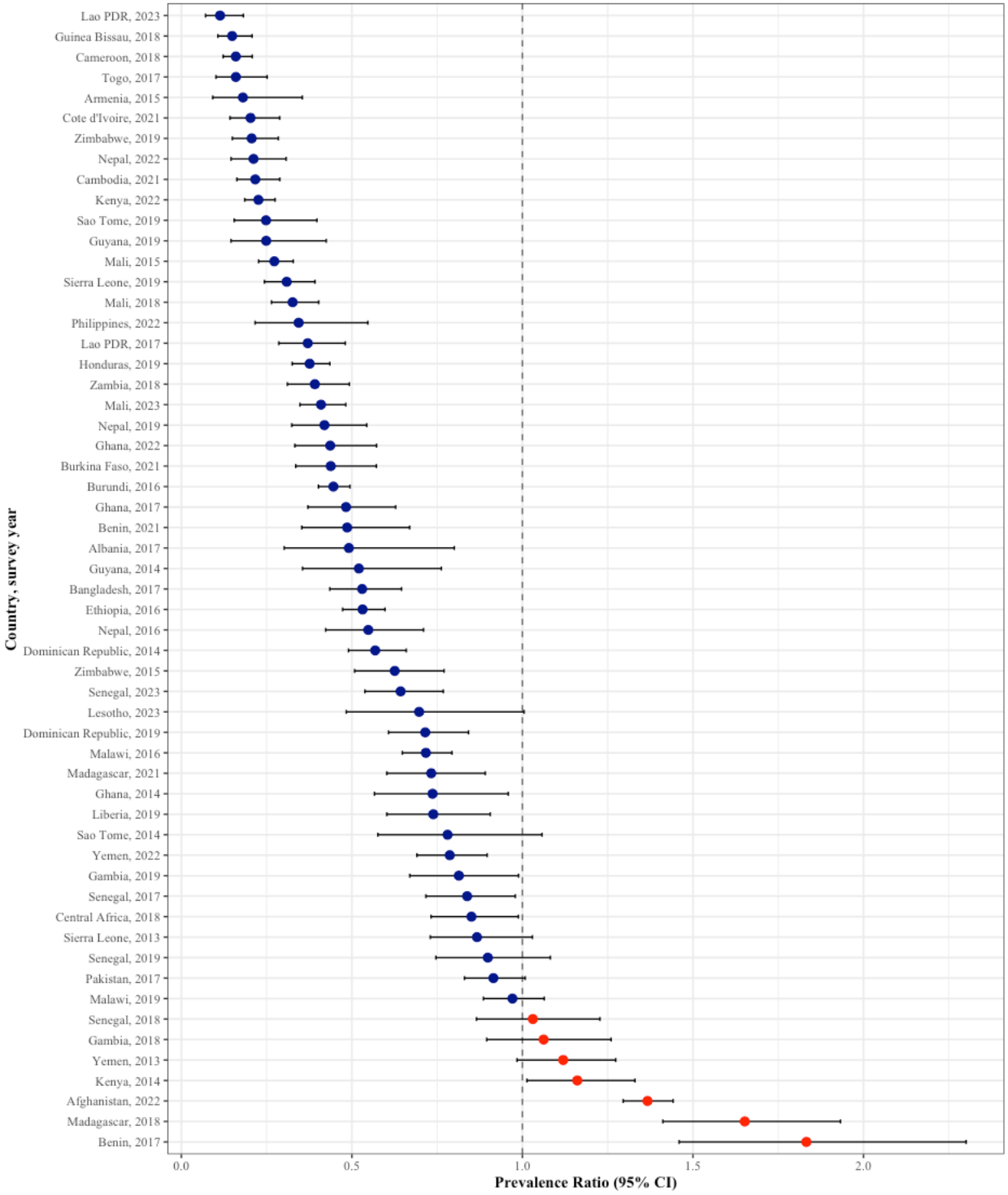
1. SD: Standard Deviation, SES: Socioeconomic Status
2. p-value calculated using Wilcoxon rank-sum test
3. Obesity was defined as having a body mass index (BMI) greater than 27.5
4. Summer runs from March to May, Monsoon runs from June to September, Autumn runs from October to November, and Winter runs from December to February

Appendix C. Chapter 3 Supplementary Figures and Tables

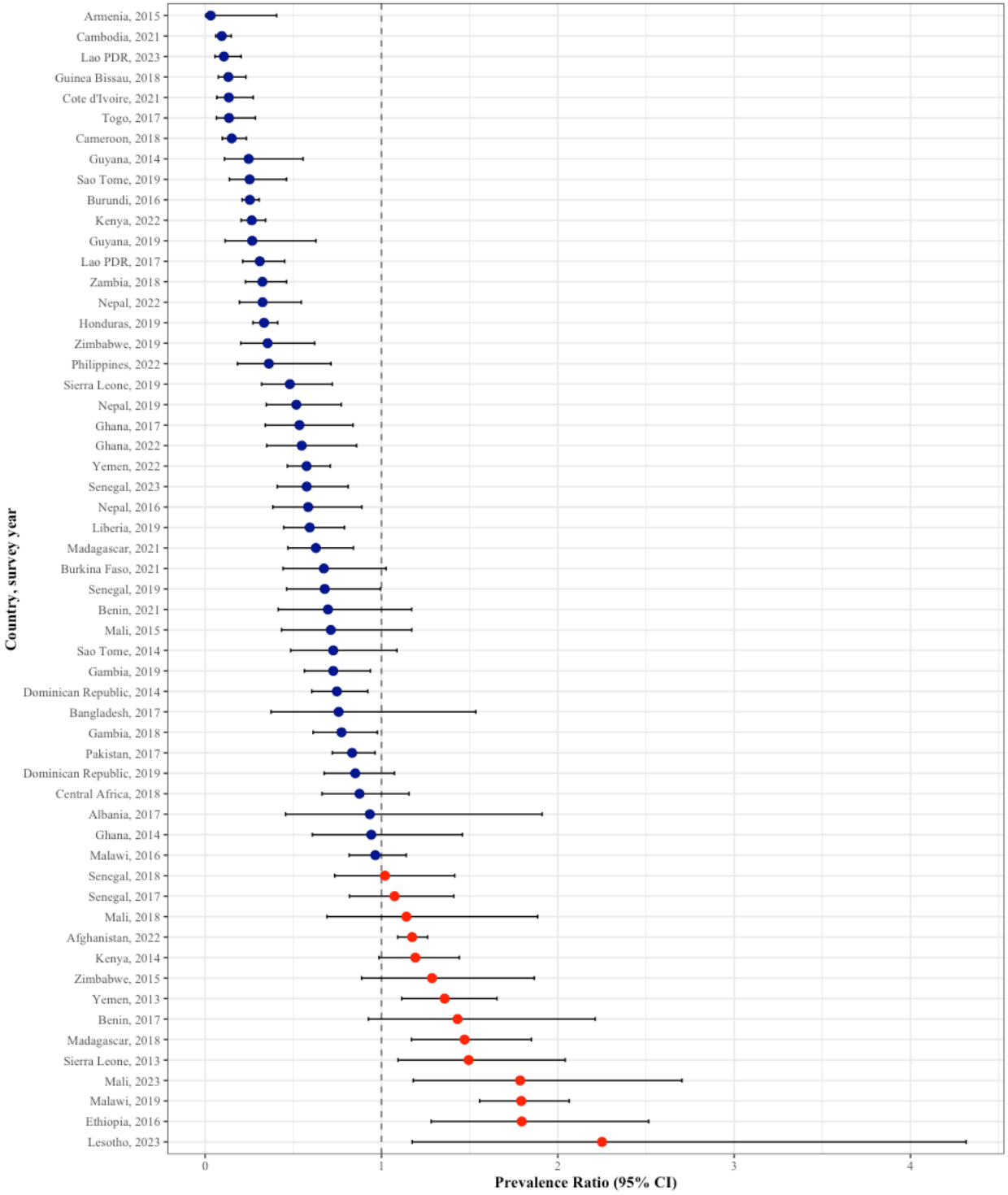
Supplementary Figure 13. PCV Coverage by Country and Survey Year



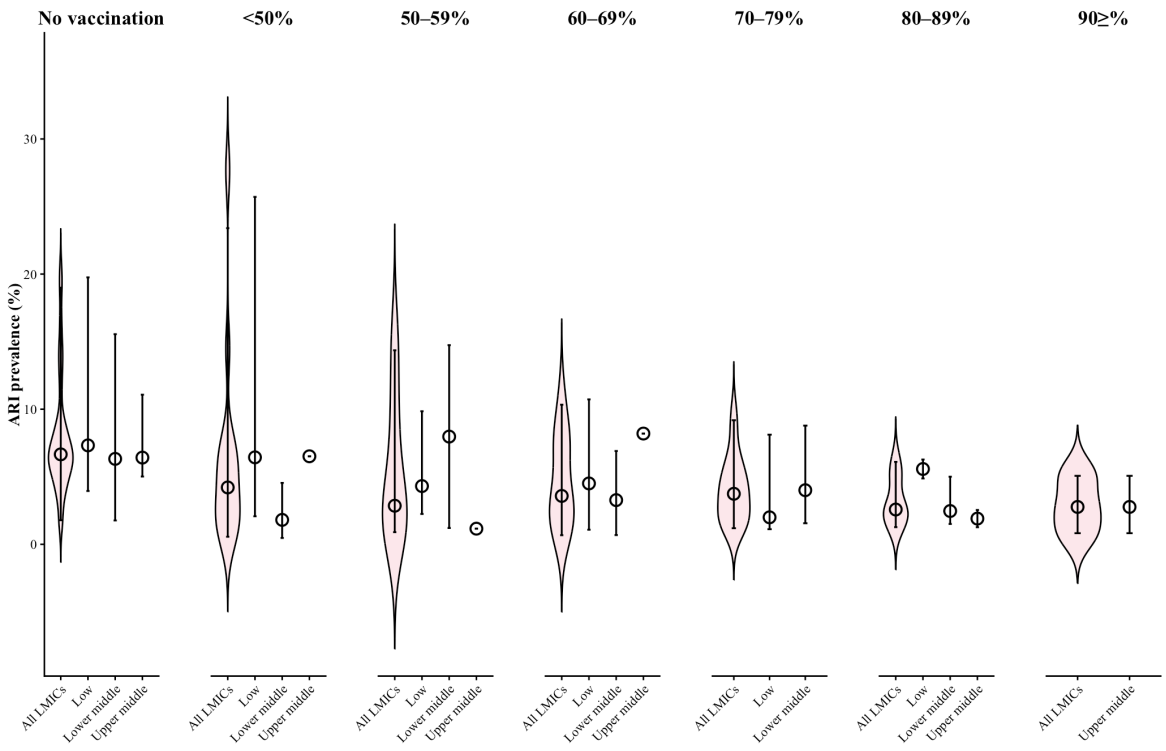
Supplementary Figure 14. ARI Prevalence Ratio by Country and Survey year



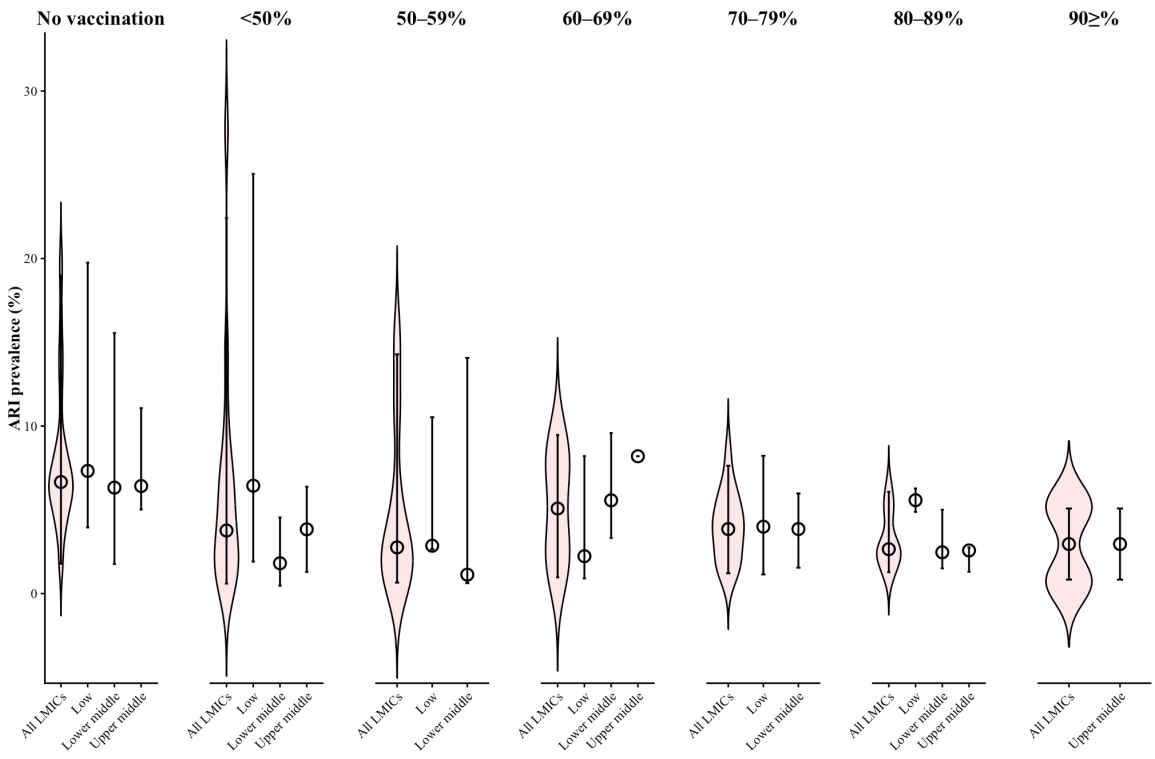
Supplementary Figure 15. Antibiotic use Prevalence Ratio by Country and Survey Year



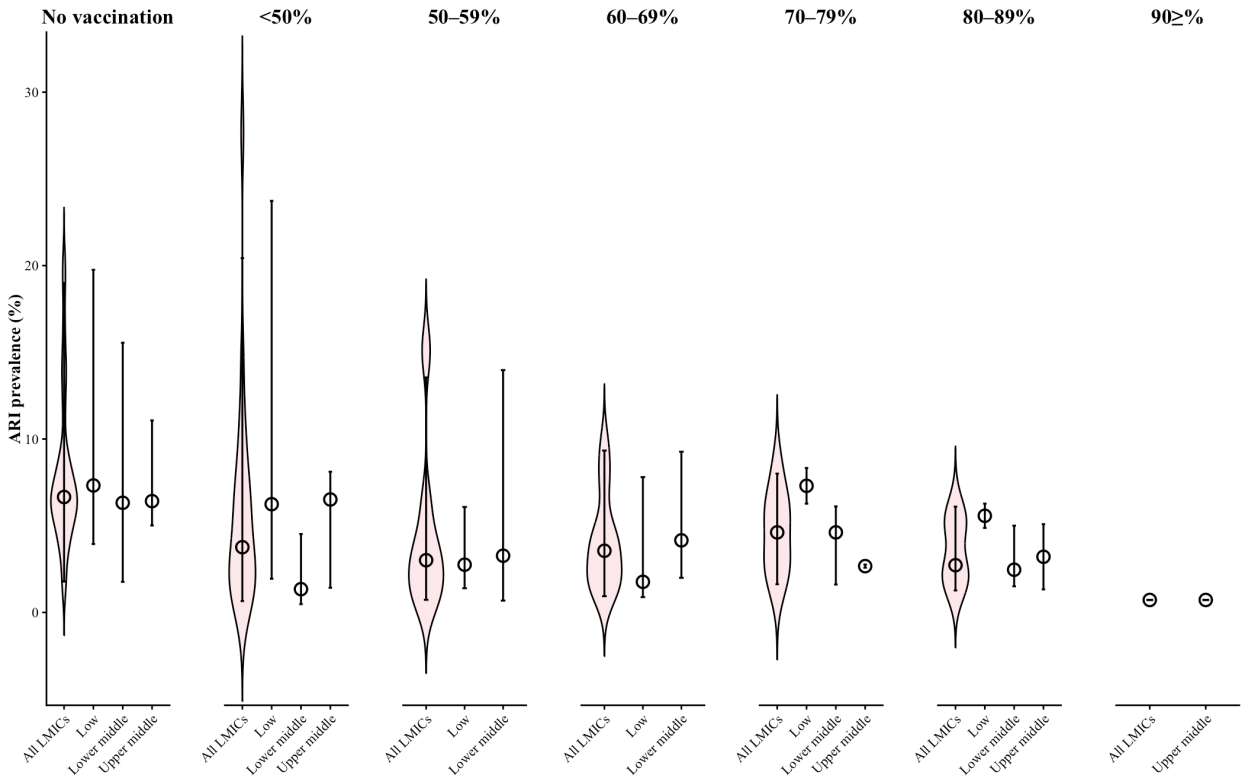
Supplementary Figure 16. PCV1 coverage range by income categories



Supplementary Figure 17. PCV2 coverage range by income categories



Supplementary Figure 18. PCV3 coverage range by income categories



Supplementary Table 5. ARI and Antibiotic use prevalence ratio by country-year[1,2]

Country	Year	PCV status	Total N	ARI N (%)	Abx use N (%)	ARI PR (95% CI)	p-val	Abx use PR (95% CI)	p-val
Afghanistan	2010	Pre	6,758	1,370 (20.27%)	872 (12.90%)	1.3 (1.3, 1.44)	<0.001	1.17 (1.09, 1.26)	<0.001
	2022	Post	15,804	4,377 (27.69%)	2,393 (15.14%)				
Albania	2005	Pre	483	27 (5.63%)	10 (2.13%)	0.49 (0.3, 0.8)	<0.05	0.93 (0.46, 1.91)	0.85
	2017	Post	1,283	35 (2.77%)	26 (1.99%)				
Angola[3]	2015	Post	6,420	242 (3.76%)	129 (2.00%)	-	-	-	-
	2023	Post	4,781	109 (2.27%)	55 (1.15%)				
Armenia	2010	Pre	776	50 (6.42%)	18 (2.26%)	0.19 (0.10, 0.36)	<0.001	0.06 (0.01, 0.38)	<0.05
	2015	Post	854	10 (1.16%)	1 (0.07%)				
Bangladesh	2014	Pre	4,053	267 (6.58%)	17 (0.43%)	0.53 (0.44, 0.65)	<0.001	0.76 (0.37, 1.54)	0.44
	2017	Post	4,189	146 (3.49%)	14 (0.33%)				
Benin	2011	Pre	6,204	111 (1.79%)	34 (0.54%)	1.83 (1.46, 2.3)	<0.001	1.42 (0.92, 2.2)	0.11
	2017	Post	6,397	209 (3.27%)	50 (0.78%)				
	2021	Post	6,433	56 (0.87%)	24 (0.38%)	0.49 (0.36, 0.67)	<0.001	0.7 (0.42, 1.17)	0.18
Burkina Faso	2006	Pre	2,894	56 (0.87%)	24 (0.38%)	0.44 (0.34, 0.57)	<0.001	0.67 (0.44, 1.03)	0.07
	2016	Post	5,407	117 (4.03%)	38 (1.33%)				
Burundi	2010	Pre	3,862	96 (1.77%)	48 (0.89%)	0.45 (0.4, 0.49)	<0.001	0.25 (0.21, 0.31)	<0.001
Burundi	2016	Post	6,543	727 (18.81%)	339 (8.78%)				
Cambodia	2014	Pre	3,589	549 (8.38%)	146 (2.23%)	0.22 (0.16, 0.29)	<0.001	0.1 (0.06, 0.15)	<0.001
Cambodia	2021	Post	3,960	236 (6.59%)	196 (5.47%)				
Cameroon	2006	Pre	3,264	57 (1.43%)	20 (0.51%)	0.16 (0.12, 0.21)	<0.001	0.15 (0.1, 0.23)	<0.001
Cameroon	2018	Post	4,675	287 (8.80%)	111 (3.40%)				
Central Africa	2010	Pre	5,439	66 (1.40%)	24 (0.51%)	0.85 (0.73, 0.99)	<0.05	0.88 (0.66, 1.16)	0.35
	2018	Post	4,254	266 (6.24%)	82 (1.92%)				
Costa Rica[3]	2018	Post	187,870	9,751 (5.19%)	4,342 (2.31%)	-	-	-	-
Cote d'Ivoire	2011	Pre	3,569	150 (4.20%)	53 (1.48%)	0.2 (0.14, 0.29)	<0.001	0.13 (0.07, 0.27)	<0.001
	2021	Post	4,497	38 (0.85%)	9 (0.20%)				
Dominican Republic	2013	Pre	1,783	204 (11.46%)	101 (5.64%)	0.57 (0.49, 0.66)	<0.001	0.74 (0.6, 0.92)	<0.05
	2014	Post	10,182	663 (6.51%)	429 (4.21%)				
	2019	Post	4,290	352 (8.20%)	206 (4.80%)	0.71 (0.61, 0.84)	<0.001	0.85 (0.67, 1.07)	0.17
Ethiopia	2005	Pre	4,840	711 (14.70%)	51 (1.06%)	0.53 (0.47, 0.6)	<0.001	1.8 (1.28, 2.52)	<0.001
	2016	Post	5,019	392 (7.81%)	95 (1.90%)				
Fiji[3]	2022	Post	1,074	8 (0.72%)	5 (0.49%)	-	-	-	-

Gambia	2005	Pre	3,550	211 (5.94%)	134 (3.79%)	1.06 (0.89, 1.26)	0.49	0.77 (0.61, 0.98)	<0.05
	2018	Post	4,727	298 (6.31%)	138 (2.93%)				
	2019	Post	3,638	176 (4.84%)	100 (2.75%)	0.81 (0.67, 0.99)	<0.05	0.73 (0.56, 0.94)	<0.05
Ghana	2006	Pre	1,705	96 (5.65%)	32 (1.90%)	0.74 (0.57, 0.96)	<0.05	0.94 (0.61, 1.45)	0.77
	2014	Post	2,796	116 (4.16%)	50 (1.79%)				
	2017	Post	4,319	118 (2.73%)	44 (1.02%)	0.48 (0.37, 0.63)	<0.001	0.53 (0.34, 0.83)	<0.05
	2022	Post	4,237	104 (2.46%)	44 (1.04%)	0.44 (0.33, 0.57)	<0.001	0.55 (0.35, 0.85)	<0.05
Guinea Bissau	2012	Pre	3,199	234 (7.32%)	91 (2.84%)	0.15 (0.11, 0.21)	<0.001	0.13 (0.07, 0.23)	<0.001
	2018	Post	3,690	40 (1.09%)	14 (0.37%)				
Guyana	2006	Pre	1,229	61 (4.95%)	23 (1.85%)	0.52 (0.36, 0.76)	<0.001	0.26 (0.12, 0.57)	<0.001
	2014	Post	1,696	44 (2.58%)	8 (0.46%)				
	2019	Post	1,360	17 (1.23%)	7 (0.49%)	0.25 (0.15, 0.43)	<0.001	0.28 (0.12, 0.64)	<0.05
Honduras	2005	Pre	5,160	721 (13.97%)	404 (7.83%)	0.38 (0.32, 0.44)	<0.001	0.34 (0.27, 0.41)	<0.001
	2019	Post	4,112	216 (5.26%)	108 (2.62%)				
Kenya	2008	Pre	2,835	239 (8.42%)	127 (4.48%)	1.16 (1.01, 1.33)	<0.05	1.19 (0.98, 1.44)	0.07
	2014	Post	9,446	923 (9.78%)	504 (5.34%)				
	2022	Post	8,392	160 (1.90%)	99 (1.18%)	0.23 (0.19, 0.27)	<0.001	0.26 (0.2, 0.34)	<0.001
Kiribati[3]	2018	Post	1,097	51 (4.66%)	37 (3.33%)	-	-	-	-
Lao PDR	2012	Pre	5,459	198 (3.63%)	110 (2.01%)	0.37 (0.3, 0.46)	<0.001	0.31 (0.22, 0.45)	<0.001
	2017	Post	1,723	77 (1.34%)	36 (0.62%)				
	2023	Post	1,145	19 (0.41%)	10 (0.21%)	0.12 (0.07, 0.18)	<0.001	0.11 (0.06, 0.21)	<0.001
Lesotho	2014	Pre	1,569	82 (5.20%)	14 (0.92%)	0.7 (0.48, 1.00)	0.05	2.22 (1.17, 4.22)	<0.05
	2023	Post	1,145	42 (3.63%)	24 (2.06%)				
Liberia	2013	Pre	3,086	241 (7.80%)	145 (4.71%)	0.74 (0.6, 0.91)	<0.05	0.6 (0.45, 0.79)	<0.001
	2019	Post	2,338	135 (5.76%)	65 (2.79%)				
Madagascar	2008	Pre	5,968	233 (3.90%)	117 (1.96%)	1.65 (1.41, 1.93)	<0.001	1.47 (1.17, 1.85)	<0.001
	2018	Post	6,362	409 (6.44%)	183 (2.88%)				
	2021	Post	5,821	166 (2.85%)	72 (1.23%)	0.73(0.6, 0.89)	<0.05	0.63 (0.47, 0.84)	<0.05
Malawi	2006	Pre	12,780	1,109 (8.68%)	351 (2.75%)	0.72 (0.65, 0.79)	<0.001	0.97 (0.82, 1.14)	0.68
	2016	Post	8,183	509 (6.22%)	217 (2.65%)				
	2019	Post	7,968	671 (8.42%)	392 (4.92%)	0.97 (0.89, 1.06)	0.53	1.79 (1.56, 2.06)	<0.001
Mali	2006	Pre	6,354	428 (6.73%)	33 (0.52%)	0.27 (0.23, 0.33)	<0.001	0.71 (0.44, 1.17)	0.18
	2015	Post	7,291	145 (1.83%)	29 (0.37%)				
	2018	Post	4,758	104 (2.20%)	28 (0.59%)	0.33 (0.27, 0.4)	<0.001	1.14 (0.7, 1.88)	0.6
	2023	Post	7,400	204 (2.75%)	68 (0.92%)	0.41 (0.35, 0.48)	<0.001	1.77 (1.17, 2.68)	<0.05

Nepal	2011	Pre	2,504	157 (6.26%)	59 (2.36%)	0.55 (0.42, 0.71)	<0.001	0.59 (0.39, 0.89)	<0.05
	2016	Post	2,452	84 (3.43%)	34 (1.38%)				
	2019	Post	3,214	84 (2.63%)	39 (1.22%)	0.42 (0.32, 0.54)	<0.001	0.52 (0.35, 0.77)	<0.05
	2022	Post	2,459	33 (1.32%)	19 (0.77%)	0.21 (0.15, 0.31)	<0.001	0.33 (0.2, 0.55)	<0.001
Pakistan	2006	Pre	4,010	662 (16.50%)	340 (8.47%)	0.91 (0.83, 1.01)	0.07	0.83 (0.72, 0.96)	<0.05
	2017	Post	4,710	711 (15.09%)	333 (7.06%)				
Philippines	2017	Pre	4,753	83 (1.75%)	37 (0.79%)	0.35 (0.22, 0.55)	<0.001	0.37 (0.19, 0.73)	<0.05
	2022	Post	3,730	22 (0.60%)	11 (0.29%)				
Sao Tome	2008	Pre	886	82 (9.28%)	50 (5.66%)	0.78 (0.58, 1.06)	0.11	0.73 (0.49, 1.09)	0.12
	2014	Post	988	72 (7.24%)	41 (4.11%)	0.25 (0.16, 0.4)	<0.001	0.26 (0.14, 0.47)	<0.001
	2019		906	21 (2.30%)	13 (1.43%)	0.84 (0.72, 0.98)	<0.05	1.07 (0.82, 1.41)	0.61
Senegal	2010	Pre	5,492	329 (5.99%)	99 (1.79%)	1.03 (0.87, 1.23)	0.73	1.02 (0.74, 1.42)	0.89
	2017	Post	5,467	274 (5.02%)	105 (1.93%)				
	2018	Post	2,984	184 (6.17%)	55 (1.83%)				
	2019	Post	2,876	155 (5.38%)	35 (1.22%)	0.9 (0.75, 1.08)	0.26	0.68 (0.47, 1.00)	0.05
	2023	Post	4,650	179 (3.85%)	48 (1.03%)	0.64 (0.54, 0.77)	<0.001	0.58 (0.41, 0.81)	<0.05
Sierra Leone	2008	Pre	2,634	190 (7.22%)	51 (1.95%)	0.87 (0.73, 1.03)	0.1	1.48 (1.09, 2.03)	<0.05
	2013	Post	5,335	334 (6.26%)	155 (2.91%)				
	2019	Post	4,449	99 (2.23%)	42 (0.94%)	0.31 (0.24, 0.39)	<0.001	0.48 (0.32, 0.72)	<0.001
Togo	2010	Pre	2,357	127 (5.39%)	55 (2.33%)	0.16 (0.1, 0.25)	<0.001	0.14 (0.06, 0.28)	<0.001
	2017	Post	2,491	21 (0.86%)	8 (0.32%)				
Uganda[3]	2016	Post	7,330	810 (11.06%)	361 (4.92%)	-	-	-	-
Yemen	2006	Pre	1,894	245 (12.94%)	109 (5.77%)	1.12 (0.98, 1.27)	0.09	1.35 (1.11, 1.65)	<0.001
	2013	Post	7,643	1,107 (14.48%)	599 (7.84%)				
	2022	Post	10,108	1,029 (10.18%)	335 (3.32%)	0.79 (0.69, 0.90)	<0.001	0.57 (0.47, 0.71)	<0.001
Zambia	2007	Pre	3,071	186 (6.07%)	92 (3.00%)	0.39 (0.31, 0.49)	<0.001	0.33 (0.23, 0.46)	<0.001
	2018	Post	4,677	111 (2.38%)	46 (0.97%)				
Zimbabwe	2009	Pre	3,547	244 (6.88%)	53 (1.48%)	0.63 (0.51, 0.77)	<0.001	1.29 (0.89, 1.86)	0.18
	2015	Post	2,979	128 (4.30%)	57 (1.91%)				
	2019	Post	3,001	43 (1.42%)	16 (0.53%)	0.21 (0.15, 0.29)	<0.001	0.36 (0.21, 0.63)	<0.001

1. For countries with more than one post-PCV survey, each pre-PCV survey was used for the prevalence ratio calculation
2. PCV: Pneumococcal conjugate vaccine, ARI: Acute respiratory infection, Abx: Antibiotic, PR: Prevalence ratio, p-val: p-value
3. No pre-PCV surveys

Supplementary Table 6. Annual mean PCV coverage overall and by country income group

Year	Total country	Income group	Total children	PCV1		PCV2		PCV3	
				N[1]	Mean Coverage (%)	N[1]	Mean Coverage (%)	N[1]	Mean Coverage (%)
2013	2	Overall	12,977	6,714	54.09%	6,389	51.57%	5,834	47.08%
	2	Low	12,977	6,714	54.09%	6,389	51.57%	5,834	47.08%
	-	Lower-middle	-	-	-	-	-	-	-
	-	Upper-middle	-	-	-	-	-	-	-
2014	5	Overall	25,107	13,077	63.61%	11,955	60.58%	10,312	
	-	Low	-	-		-		-	
	3	Lower-middle	13,230	9,438	70.55%	9,206	68.68%	8,758	65.58%
	2	Upper-middle	11,877	3,638	53.21%	2,749	48.43%	1,554	40.40%
2015	4	Overall	18,174	7,513	48.23%	6,973	45.28%	6,161	40.30%
	1	Low	7,921	2,512	31.72%	2,370	29.92%	2,141	27.03%
	2	Lower-middle	9,399	4,568	55.28%	4,202	52.13%	3,679	47.12%
	1	Upper-middle	854	432	50.65%	401	46.94%	341	39.95%
2016	5	Overall	29,528	17,622	54.06%	16,904	51.23%	15,518	46.08%
	4	Low	27,076	16,798	59.17%	16,212	56.98%	15,044	52.77%
	1	Lower-middle	2,452	824	33.62%	692	28.22%	474	19.32%
	-	Upper-middle	-	-	-	-	-	-	-
2017	8	Overall	34,623	22,364	68.07%	21,764	66.40%	20,696	62.29%
	1	Low	2,491	1,691	67.87%	1,633	65.55%	1,540	61.81%
	6	Lower-middle	30,849	19,517	64.42%	18,993	62.83%	18,198	60.31%
	1	Upper-middle	1,283	1,157	90.18%	1,137	88.65%	958	74.65%
2018	11	Overall	225,093	192,106	60.22%	191,303	58.82%	188,167	55.82%
	5	Low	23,790	13,071	56.07%	12,667	54.33%	11,894	50.92%
	5	Lower-middle	13,433	8,766	57.81%	8,559	56.51%	8,100	53.53%
	1	Upper-middle	187,870	170,268	90.63%	170,077	90.53%	168,173	89.52%
2019	11	Overall	38,153	28,368	76.26%	27,641	74.41%	25,356	68.67%
	4	Low	18,394	13,196	71.71%	12,924	69.79%	12,425	66.32%
	5	Lower-middle	14,109	11,014	79.31%	10,869	78.34%	10,280	74.72%
	2	Upper-middle	5,650	4,158	77.75%	3,848	73.81%	2,651	58.23%
2021	5	Overall	26,118	15,496	61.10%	14,841	58.54%	13,838	54.59%
	2	Low	11,228	7,193	64.50%	6,990	62.69%	6,568	58.90%

	3	Lower-middle	14,890	8,303	58.84%	7,851	55.77%	7,270	51.72%
	-	Upper-middle	-	-	-	-	-	-	-
2022	7	Overall	45,803	27,729	69.07%	26,448	67.01%	24,544	62.69%
	2	Low	25,912	13,142	51.08%	12,094	47.00%	10,940	42.51%
	4	Lower-middle	18,818	13,589	72.10%	13,361	70.65%	12,614	65.42%
	1	Upper-middle	1,074	998	92.92%	993	92.51%	989	92.15%
2023	5	Overall	22,567	12,847	59.04%	12,198	56.35%	11,225	51.99%
	1	Low	7,400	4,556	61.57%	4,374	59.11%	4,045	54.67%
	4	Lower-middle	15,167	8,290	58.41%	7,824	55.66%	7,179	51.32%
	-	Upper-middle	-	-	-	-	-	-	-

1. Number of children who received each respective PCV dose

Supplementary Table 7. Association Between PCV Introduction and Antibiotic Use During a Diarrheal Episode[1]

Group	Level	Antibiotic use		
		aß (95% CI)	p-val	p-val[2]
Overall	-	0.009 (-0.012, 0.03)	0.361	-
Age	6-11 m	0.013 (-0.014, 0.04)	0.314	0.079
	12-23 m	0.008 (-0.009, 0.026)	0.312	
	24-35 m	0.002 (-0.016, 0.019)	0.842	
Baseline ARI	< 5%	-0.014 (-0.038, 0.01)	0.143	0.499
	5-9%	0.064 (0.02, 0.108)	0.027	
	≥10%	-0.001 (-0.021, 0.02)	0.94	

1. PCV: Pneumococcal conjugate vaccine, m: months
2. p-value calculated by Wald test

Supplementary Table 8. Association Between PCV coverages and Antibiotic Use During a Diarrheal Episode[1]

Group	Dose	Level	aß (95% CI)	p-val	p-val	aRD (95% CI)	p-val	p-val
Overall	PCV1	-	0.008 (-0.019, 0.034)	0.547	-	-0.018 (-0.288, 0.251)	0.832	-
	PCV2	-	0.008 (-0.019, 0.035)	0.562	-	-0.02 (-0.271, 0.23)	0.803	-
	PCV3	-	0.009 (-0.019, 0.037)	0.492	-	-0.012 (-0.282, 0.257)	0.898	-
Age	PCV1	6-11 m	0.01 (-0.021, 0.042)	0.506	0.068	-0.095 (-0.282, 0.092)	0.16	0.397
		12-23 m	0.01 (-0.012, 0.032)	0.352		0.003 (-0.161, 0.167)	0.954	
		24-35 m	-0.006 (-0.024, 0.013)	0.533		0.07 (-0.227, 0.367)	0.552	
	PCV2	6-11 m	-0.089 (-0.255, 0.076)	0.158	0.488	-0.095 (-0.267, 0.078)	0.153	0.371
		12-23 m	0.003 (-0.15, 0.155)	0.951		0.003 (-0.148, 0.154)	0.942	
		24-35 m	0.018 (-0.289, 0.324)	0.892		0.004 (-0.305, 0.314)	0.973	
	PCV3	6-11 m	-0.112 (-0.312, 0.087)	0.169	0.533	-0.116 (-0.329, 0.097)	0.178	0.496
		12-23 m	0.007 (-0.139, 0.153)	0.884		0.008 (-0.137, 0.153)	0.865	
		24-35 m	0.034 (-0.226, 0.295)	0.749		0.014 (-0.282, 0.309)	0.903	
Baseline ARI[3]	PCV1	< 5%	-0.014 (-0.079, 0.051)	0.522	0.491	-	-	-
		5-9%	0.003 (-0.024, 0.03)	0.581		-	-	-
		≥10%	0.057 (-0.571, 0.685)	0.589		-	-	-
	PCV2	< 5%	-0.013 (-0.082, 0.057)	0.564	0.426	-	-	-
		5-9%	0.003 (-0.025, 0.031)	0.696		-	-	-
		≥10%	0.042 (-0.744, 0.827)	0.801		-	-	-
	PCV3	< 5%	-0.013 (-0.086, 0.06)	0.803	0.717	-	-	-
		5-9%	0.002 (-0.026, 0.03)	0.822		-	-	-
		≥10%	0.036 (-0.892, 0.964)	0.878		-	-	-

1. PCV: Pneumococcal conjugate vaccine, RD: Risk difference m: months
2. p-value calculated by Wald test
3. Insufficient heterogeneity in risk differences by baseline ARI prevalence

Supplementary Table 9. Under-five mortality rate 5 years preceding each survey year

Country	Year	PCV status	Total N	Mortality rate (per 1,000 live births)
Afghanistan	2010	Pre	6,758	102
	2022	Post	15,804	55
Albania	2005	Pre	483	19
	2017	Post	1,283	-
Angola	2015	Post	6,420	68
	2023	Post	4,781	52
Armenia	2010	Pre	776	16
	2015	Post	854	0
Bangladesh	2014	Pre	4,053	46
	2017	Post	4,189	45
Benin	2011	Pre	6,204	70
	2017	Post	6,397	96
	2021	Post	6,433	80
Burkina Faso	2006	Pre	2,894	188
	2016	Post	5,407	70
Burundi	2010	Pre	3,862	96
Burundi	2016	Post	6,543	78
Cambodia	2014	Pre	3,589	35
Cambodia	2021	Post	3,960	16
Cameroon	2006	Pre	3,264	144
Cameroon	2018	Post	4,675	28
Central Africa	2010	Pre	5,439	179
	2018	Post	4,254	99
Costa Rica	2018	Post	187,870	-
Cote d'Ivoire	2011	Pre	3,569	43
	2021	Post	4,497	74
Dominican Republic	2013	Pre	1,783	31
	2014	Post	10,182	35
	2019	Post	4,290	32
Ethiopia	2005	Pre	4,840	123
	2016	Post	5,019	67
Fiji	2022	Post	1,074	18
Gambia	2005	Pre	3,550	131
	2018	Post	4,727	57
	2019	Post	3,638	56
Ghana	2006	Pre	1,705	71
	2014	Post	2,796	60
	2017	Post	4,319	56
	2022	Post	4,237	40
Guinea Bissau	2012	Pre	3,199	123
	2018	Post	3,690	51
Guyana	2006	Pre	1,229	47
	2014	Post	1,696	39
	2019	Post	1,360	25

Honduras	2005	Pre	5,160	23
	2019	Post	4,112	21
Kenya	2008	Pre	2,835	74
	2014	Post	9,446	52
	2022	Post	8,392	41
Kiribati	2018	Post	1,097	61
Lao PDR	2012	Pre	5,459	79
	2017	Post	1,723	46
	2023	Post	1,145	28
Lesotho	2014	Pre	1,569	85
	2023	Post	1,145	76
Liberia	2013	Pre	3,086	54
	2019	Post	2,338	94
Madagascar	2008	Pre	5,968	93
	2018	Post	6,362	72
	2021	Post	5,821	590
Malawi	2006	Pre	12,780	75
	2016	Post	8,183	122
	2019	Post	7,968	63
Mali	2006	Pre	6,354	56
	2015	Post	7,291	191
	2018	Post	4,758	108
	2023	Post	7,400	54
Nepal	2011	Pre	2,504	87
	2016	Post	2,452	54
	2019	Post	3,214	39
	2022	Post	2,459	28
Pakistan	2006	Pre	4,010	38
	2017	Post	4,710	94
Philippines	2017	Pre	4,753	74
	2022	Post	3,730	27
Sao Tome	2008	Pre	886	26
	2014	Post	988	63
	2019	Post	906	45
Senegal	2010	Pre	5,492	14
	2017	Post	5,467	72
	2018	Post	2,984	56
	2019	Post	2,876	51
	2023	Post	4,650	37
Sierra Leone	2008	Pre	2,634	40
	2013	Post	5,335	140
	2019	Post	4,449	156
Togo	2010	Pre	2,357	122
	2017	Post	2,491	124
Uganda[3]	2016	Post	7,330	71
Yemen	2006	Pre	1,894	64
	2013	Post	7,643	78
	2022	Post	10,108	53
Zambia	2007	Pre	3,071	6

	2018	Post	4,677	119
Zimbabwe	2009	Pre	3,547	61
	2015	Post	2,979	86
	2019	Post	3,001	69